

**INFORMATION SHEET FOR THE
FY2022 NOAA/OAR/WPO VORTEX-USA COMPETITION**

General program priorities for interdisciplinary studies and transition to the Weather Enterprise

VORTEX-USA is a research program intended to improve the effectiveness of tornado forecasts and warnings in the U.S. This program represents an evolution from the VORTEX-SE program of 2015-2020. VORTEX-USA will extend the approaches and findings from that program to other regions of the U.S., while maintaining a strong emphasis on Southeast issues. New meteorological knowledge will be gained through examination of historical data, special datasets collected in the field through earlier VORTEX-SE campaigns, and the application of state-of-the-art numerical weather prediction and data assimilation systems. VORTEX-USA will also explore avenues for more effectively communicating tornado forecasts to the public, and evaluate aspects of public vulnerability, risk perception and response to these forecasts in order to more effectively mitigate damage, injuries, and loss of life from tornadoes.

Investigators should understand that VORTEX-USA is a program that is intended to have the *maximum possible near-term societal benefit* by reducing the impacts of tornadoes. In preparing and reviewing proposals, investigators and reviewers should assess the viability of moving results expeditiously toward application. This perspective should serve to inform investigators of the applicability of their proposal to a NOAA grant competition, in contrast with funding programs of other agencies such as the National Science Foundation. Basic research is not excluded in VORTEX-USA, but proposals for basic research carry a certain burden of convincing reviewers of a likely path toward application. The Notice of Funding Opportunity gives an example of Readiness Levels, and these should serve to give investigators a sense of how new knowledge can advance toward application in NOAA. VORTEX-USA knowledge may follow other paths leading to societal benefit through education of participants in the Weather Enterprise, insights into urban planning or codes, and a variety of diverse routes. Regardless of the exact route for transition, investigators should always consider how to advance their findings to application and positive societal impact beyond publishing and hoping that the new knowledge is “somehow” implemented.

In the past, VORTEX-SE has used several mechanisms to encourage interdisciplinary studies. The spectrum of approaches that are appropriate for VORTEX-USA-supported projects range from very narrow single-discipline efforts, to efforts that can only effectively proceed when they involve more than one discipline. The latter typically are more costly, often involving two or more principal investigators. Investigators need to be aware that reviewers will scrutinize the proposed budgets. Single-discipline proposals are not expected to generally cost near the annual grant limit (\$500,000/project), while necessary inter-discipline collaboration may more easily justify budgets near the grant limit. In past

competitions, VORTEX-SE has limited single-discipline proposals to \$300,000/project, and many worthy proposals have been received that fit within that constraint.

In this competition, we do not specify any required discipline areas for individual proposals. The mix of disciplines should be that which best facilitates the research goals.

Collaboration with elements of the Weather Enterprise

Past competitions have encouraged investigators to form collaborations with the Weather Enterprise, especially the NWS. Indeed, the first proposal review criterion (30 points weight) continues to be an assessment of the relevance to the Weather Enterprise, including NOAA. The general result from the past has been the inclusion of letters of endorsement in proposals, but often only weak collaborative efforts have ensued. In this competition, we *discourage the practice of including letters of endorsement*. On the other hand, we wish to encourage actual collaborations with the Weather Enterprise where possible and useful. Hence, it will be a strength if proposals include an investigator(s) engaged in the operational aspects of the Weather Enterprise, and show a *substantive role* for that investigator(s) in the conduct of the project.

PERiLS

VORTEX-USA, in collaboration with the National Science Foundation, is supporting a major field program in the Southeast U.S. in the 2021-22 and 2022-23 Spring seasons called the Propagation, Evolution, and Rotation in Linear Storms (PERiLS). This NOFO will *not* accept proposals for utilizing PERiLS data sets because no data will have been collected at the time of this competition. Further, proposals to deploy instruments in PERiLS will *not* be considered; investigators interested in collecting data should contact the VORTEX-USA Program Manager for more information. Investigators can expect that future VORTEX-USA grant competitions may include support for analysis of PERiLS data.

Elaboration of Science Emphases

This section supplements the brief descriptions of program priorities from the funding opportunity announcement.

VORTEX-USA is seeking to continually improve the awareness of tornado potential in the time frame between typical warnings and watches (e.g. 20 min - 2 h). This should lead to improved warnings owing to enhanced situational awareness, and by improving threat awareness in these longer time frames, some vulnerabilities can be reduced. This is the motivation for the program priority described as

VORTEX-USA-1, where through a more comprehensive understanding of the operationally detectable state of convection, we can perhaps deduce new signals for tornado probability in these intermediate time periods.

In the last six years, VORTEX-SE has had difficulty producing new understanding of the tornadogenesis process in Southeast US convection. This is due, in part, to the difficulty in generating reliable wind analysis from multiple Doppler radars, owing to terrain irregularities, radar horizon issues, etc. These issues may be relevant in other regions as well as we transition to VORTEX-USA. These concerns motivate the priority described as VORTEX-USA-2.

In general, forecasting for VORTEX-SE observing campaigns has proven very difficult, perhaps mirroring general difficulties in tornado forecasting in this region compared to others. Difficulties span the time scales from minutes to days. The meteorological emphases in this funding opportunity are motivated by these problems. In this competition, we are strongly encouraging researchers to utilize the large amount of sounding data that have been collected in previous VORTEX-SE observing campaigns. The subjective impression of VORTEX-SE participants is that there are important details in the low-level (e.g. below 1000 m) temperature, humidity, and wind structure that are fundamentally important in diagnosing tornado threat, but not fully characterized by currently used forecast parameters.

This VORTEX-USA NOFO also encourages proposals to undertake storm process studies utilizing the special data sets from earlier VORTEX-SE campaigns. Special challenges have been encountered, such as radar beam blockage, irregular terrain, etc. that hamper efforts using traditional research data analysis approaches for process studies. Novel techniques for taking maximum advantage of these less-than-ideal data sets are encouraged.

VORTEX-USA seeks to encourage new research related to sheltering and vulnerability, perhaps spanning more than one emphasis area and involving more than one academic discipline, possibly including disciplines such as engineering. In particular, a better understanding of methods to reduce structural vulnerability in common residential structures in the Southeast (e.g., mobile homes, manufactured homes, slab construction), vulnerability of structures to the local environment and wind-driven debris, and better sheltering advice for residents in all types of structures, environments, and tornadoes is desired. Studies that assess the utility of improved messaging in the time and space scales between warnings and watches are especially encouraged.

There is an increasing need for integrating prior VORTEX-SE vulnerability research findings with NWS and IWT partner operations. For instance, the impact of disabilities on ability to move to safe spaces (if available) including temporal implications and the potential for increased risk to these populations, provides one example of what should be addressed.

There is also a growing need to build knowledge and capacity of Integrated Warning Teams (IWTs), through the VORTEX-USA program, to encourage more households and communities to build on the strategies that people are most willing to adopt to better protect themselves when tornadoes threaten. Such strategies should leverage IWT social networks, seeking to widen them to include public participation to better understand needs, barriers and solutions to preparedness and mitigation measures.

Data management and availability

Proposals to this VORTEX-USA competition should rely on data that are currently freely available, and/or data the principal investigators will collect themselves or with formal co-investigators without requested NOAA funding through this Funding Opportunity. VORTEX-USA researchers are strongly encouraged to use existing VORTEX-USA data which are available in the catalogs maintained by UCAR's Earth Observing Laboratory (<http://data.eol.ucar.edu/>, search for "VORTEX-SE"). One example of this approach would be to use the archive of ~ 2000 soundings obtained in Meso18-19 in studies focused on Objective VORTEX-USA-2. This archive satisfies NOAA data management requirements and provides for a single distribution point for VORTEX-USA data.

Invitation to become involved

VORTEX-USA will increasingly be using an online Community Forum (<https://inside.nssl.noaa.gov/vsecommunity>) to provide information to the research community and Weather Enterprise regarding emerging results and perceptions of needed new research across the spectrum of physical, social, behavioral, economic, and engineering sciences. We encourage anyone in the community who is concerned about the meteorological and societal challenges of tornadoes to join the conversation on the Community Forum.